

# STORMWATER MANAGEMENT AND PERMEABLE PAVING UNITS

## HANOVER® Architectural Products

### ACHIEVING LEED STANDARDS

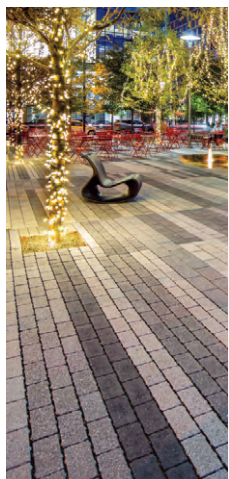
Reducing the heat island effect and managing stormwater runoff when developing a building project both contribute to achieving LEED standards. The USGBC awards LEED credits in several categories, and the number of credits and points possible differ per category. The total number of possible points a building project can acquire is 69, including 64 core points and 5 additional points for innovation.

### GAINING GROUND

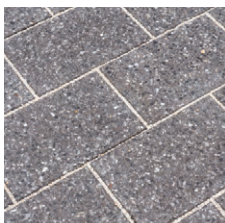
Evidence is mounting that the idea of the "green building" has finally hit the mainstream in the United States. Cities large and small are making great strides toward managing stormwater runoff and reducing the heat island effect. In New York, the rebuilding of 7 World Trade Center is focused on sustainability (using high-reflective Glacier White Hanover® Prest® Pavers), while convention centers and public parks in cities such as Pittsburgh, PA; Chattanooga, TN; and Bloomington, IN; are making use of high-reflective and permeable pavers to create environment-friendly developments. The need for sustainability continues to grow as energy and natural resources become increasingly scarce.

For additional information, trends in green building, and case studies, check out the following websites:

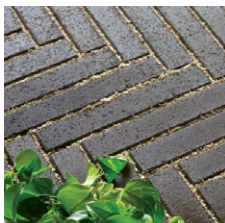
[www.epa.gov](http://www.epa.gov)  
[www.usgbc.org](http://www.usgbc.org)  
[www.advancedpavement.com](http://www.advancedpavement.com)



Permeable 4" x 8"



Permeable 12" x 18"



Permeable 3 1/4" x 18"

### HANOVER® PREST® PAVERS AND LIFE-CYCLE COSTING

Along with their viability for use in green building projects, Hanover® concrete pavers have become an increasingly popular choice as architects and builders continue to look at life-cycle costing when specifying materials. Manufacturing has improved for pavers in regard to their durability and builders can now mechanically install many of these products that previously required expensive manual installation.

As repairs become necessary in the paving itself or systems that lie beneath the pavers—whether drainage, electrical work, gas pipes, air conditioning ducts, etc.—it is often simpler to remove and replace individual pavers as repairs are needed than it is to cut into asphalt or concrete coverings. Many builders have identified savings in the following areas:



Permeable 4 1/2" x 9"

- Expensive equipment is not required for removal
- Pavers can be reinstated after the repair
- Traffic interruptions and delays are reduced
- When removed, there is no damage to surrounding units
- Pavers do not leave visible patches to detract from the aesthetics

### EFFICIENT LAND USE

Clearly on the EPA radar since 1977, stormwater management is not a new topic. In the past, however, stormwater management and efficient land use might have been considered mutually exclusive, as post-development runoff was generally controlled by either a retention or detention pond.

**RETENTION POND** — A retention pond is designed to hold a specific amount of water indefinitely. Usually the pond is designed to have drainage leading to another location when the water level gets above the pond capacity.

**DETENTION POND** — A detention pond is a dry area that is designed to temporarily hold a set amount of water while slowly draining to another location.

Regardless of the technique, both types of ponds often require that large land areas be set aside and undeveloped on a given building site. Though still in use, retention and detention ponds are on the decline as architects and builders turn to permeable concrete pavers for parking lots, sidewalks, and plazas. The result is more flexibility in design options and more efficient use of the total building site, while at the same time maintaining an effective stormwater management system.

### WHERE AM I?

The USGBC recognizes three distinct climates in the United States when it comes to measuring rainfall amounts.

CLIMATE	ANNUAL RAINFALL
Humid Watershed	40 + inches
Semi-arid Watershed	20 to 40 inches
Arid Watershed	< 20 inches

For the Stormwater Design: Quality Control credit, LEED calculates that 90 percent of the average rainfall is equivalent to treating the runoff from

CLIMATE	ANNUAL RAINFALL
Humid Watershed	1 inch of rainfall
Semi-arid Watershed	0.75 inches of rainfall
Arid Watershed	0.5 inches of rainfall

### WHAT IS A DESIGN STORM?

A "design storm" is a rainfall event of specified size and return frequency which is used to calculate runoff volume. A key element in the definition is "return frequency." A 2-year design storm has a return frequency of 2 years; a 10-year, 10 years; and so on.

A return frequency, is based on statistics and doesn't actually represent a specific time period. The year designation equals the inverse of the probability that a storm of a particular magnitude will occur in a 1-year time period. Thus, a 2-year storm has a 50 percent (1/2) chance of happening in any one year; a 10-year storm a 10 percent (1/10) etc. In practice, return frequencies are selected on the concept of level of protection, which is largely based on local experience.

### HANOVER® ARCHITECTURAL PRODUCTS

Hanover® Architectural Products has been considered a leader and at the forefront of unit paver system development since 1971. Hanover® manufactures a variety of products ranging from small hand-held Prest® Brick and Asphalt Block, to larger scaled Prest® Pavers. Hanover® can also provide vertical walling products. Visit [www.hanoverpavers.com](http://www.hanoverpavers.com) for more information.

There are more than 76 million residential buildings and nearly 5 million commercial buildings in the U.S. today. These buildings together use approximately one-third of all the energy consumed in the U.S. and two-thirds of the electricity. In addition, traditional construction methods generate inordinate amounts of waste while, at the same time, taxing sources of raw materials.\* Water consumption and a building site's impact on water quality are also major concerns for cities—large and small—throughout the country. By addressing these concerns in their projects, architects, builders, and owners stand to benefit in a number of ways, from municipal incentive programs to drastically reduced annual operational costs and higher real estate value.

When it comes to identifying best practices and guidelines for green building design and construction in this country, the U.S. Green Building Council (USGBC) offers the most widely accepted standards, based on their LEED (Leadership in Energy and Environmental Design) Green Building Rating System. This tool provides a framework under which building design and construction decisions can be made and sustainable building projects can be evaluated.

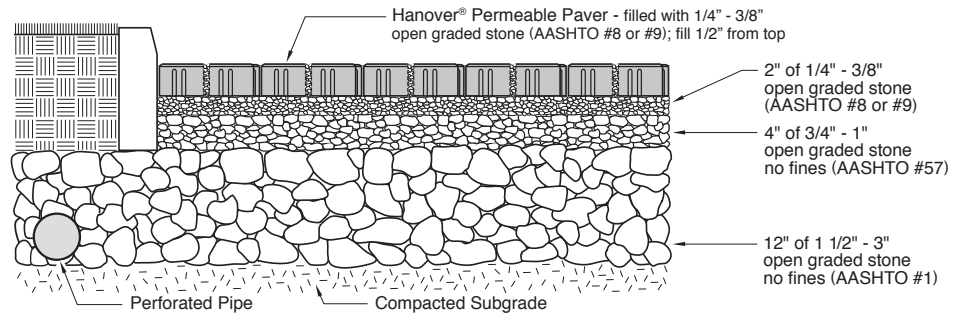
Building projects earn points for compliance with individual Sustainable Sites (SS) Credits, and the total points earned result in an overall rating for the building. Ratings range from "Certified" to "Platinum". This article focuses on how concrete pavers can play an integral role in green building projects and earning SS Credits toward an overall LEED rating.

## HANOVER® PREST® PAVERS AND STORMWATER MANAGEMENT

Since the passage of the Clean Water Act in 1977, the EPA has worked to preserve, protect, and improve the nation's water resources through control of polluted stormwater runoff. Stormwater runoff occurs in urban and suburban areas, where impervious paved areas such as streets, parking lots, and sidewalks prevent rainwater from absorbing into the soil. As stormwater runs across these surfaces, it collects urban and industrial contaminants (sediment, nutrients, bacteria, oil, metals, chemicals, road salt, litter, etc.) and deposits them into storm drains or directly into receiving waters, such as rivers and lakes. By introducing these types of pollutants to area lakes and streams, receiving waters not only become unusable to people for drinking, fishing, swimming, and other activities, they also become a dangerous environment for native fish and other aquatic life.

Though construction sites are already regulated by the National Pollutant Discharge Elimination System (NPDES) regarding the reduction of water pollution, the USGBC also addresses stormwater management in two separate SS Credits, one regarding the quantity of water that runs off a building site and the other addressing the quality of the water. Hanover® Permeable Paving Units can be integral materials in garnering both credits.

## HANOVER® PERMEABLE PAVERS: TYPICAL INSTALLATION



Please Note: Due to variations in native soil types, infiltration rates (Curve) may differ. The detail shown is an example of a typical permeable paver installation. Requirements and regulations differ for each municipality. An industry professional should be consulted to develop a specification for the individual project in accordance with the municipal requirements.

With proper installation, limestone aggregate underneath permeable pavers can remove up to 95 percent of TSS from rainwater runoff.

### SS CREDIT 6.1: STORMWATER DESIGN: QUANTITY CONTROL (1 POINT)

The intent of this LEED credit is four-fold: to reduce impervious cover, increase on-site water infiltration, reduce or eliminate pollution from runoff, and eliminate contaminants. The guidelines provide for two possible scenarios, depending on the existing imperviousness of the pre-development site and based on the one- and two-year 24-hour design storms.

#### CASE 1. EXISTING IMPERVIOUSNESS < 50%

**OPTION 1.** Implement a stormwater management plan that prevents the post-development peak runoff rate and quantity from exceeding the pre-development peak discharge rate and quantity for the 1- and 2-year 24-hour design storms.

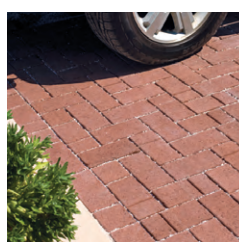
**OPTION 2.** Implement a stormwater management plan that protects receiving stream channels from excessive erosion by implementing a stream channel protection strategy and quantity control strategies.

#### CASE 2. EXISTING IMPERVIOUSNESS > 50%

Implement a stormwater management plan that results in a 25 percent decrease in the volume of stormwater runoff for the 2-year 24-hour design storm.

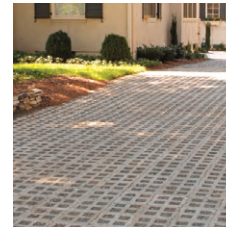
Depending on the type of application, permeable pavers can provide as much as 39 percent open space for water to infiltrate underlying grass turf or drainage aggregate. These open-grid systems are often specified for driveways, parking lots, boat launching ramps, and access roads. Choosing an interlocking, open-grid paver enhances stability and load-bearing capabilities, enabling the site to support moderate vehicular traffic, while maintaining the maximum infiltration that a normal drainage field system will accept.

In applications where aesthetics are of greater concern, such as plazas, walkways, or porte



Permeable 4 1/2"x9" Scored

cocheres, permeable pavers can offer excellent design solutions, while also mitigating stormwater runoff. Decorative pavers with open spaces for drainage aggregate can be made to order in a wide



EcoGrid®



Aqua-Loc®

variety of custom colors, and offer 10.6 percent open space to allow water to infiltrate at a rate of 7 to 8 inches per hour. Again, choosing interlocking pavers increases load-bearing capability and choosing a product that can be mechanically installed will save time and reduce costs.

Both open-grid and decorative permeable pavers can be used in green roof assemblies or in rainwater collection systems. Collected water can be reused for non-potable uses, such as landscape irrigation or toilet flushing, to fully comply with this LEED credit.

### SS CREDIT 6.2: STORMWATER DESIGN: QUALITY CONTROL (1 POINT)

Limiting disruption and pollution of natural water flows by managing stormwater runoff garners another LEED credit. By reducing impervious cover, promoting infiltration, and capturing/treating stormwater runoff from 90 percent of the average rainfall, builders and architects can protect the surrounding environment from unwanted contaminants.

For this credit, LEED requires best management practices (BMPs) that effectively remove at least 80 percent of the total suspended solids (TSS) load based on existing monitoring reports. BMPs are considered to meet these criteria if they are designed in accordance with standards and specifications from a state or local program, or there exists in-field performance monitoring data demonstrating compliance with the criteria.\*

As with the 6.1 Quantity Control credit, specifying permeable pavers can be the first step toward achieving this LEED credit. Proper assembly on limestone aggregates, however, allows for the removal up to 95 percent of TSS naturally before the water infiltrates the soil. This is one recommended system to control water quality (see above).